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On the effect of boundary layer suction on the boundary layer state at the trailing-edge and noise reduction

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Abstract

Active flow control by means of distributed boundary layer suction is utilized to affect the boundary layer state at the trailing-edge in a manner to reduce the propagated far-field noise. The present study focuses on the effect of suction mass flow rate on the boundary layer state at the trailing-edge, the formation of sound pressure level spectra and noise reduction compared to the configuration without suction. Whereas the choice of the position and area is of minor relevance for the latter properties, mass flow rate constitutes the dominating parameter. Three different numerical prediction methods are applied in order to calculate the boundary layer as well as its post-processing to obtain noise-related characteristics. Boundary layer suction is investigated using the example of wind turbine flow - an important class of engineering flows in which the emission of trailing-edge noise is quite significant. The emitted trailing-edge noise can be markedly reduced by the application of boundary layer suction.